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(54) Weapon training systems

(57) On a simulated battlefield 10 a simulated direct fire engagement between tanks 11 and 12 is underway. The simulation proceeds by virtue of direct fire weapons simulation, and is subject to the additional simulation of indirect fire. For this purpose the battlefield 10 is notionally divided into an orthogonal grid such that a zone of the battlefield may be identified by a co-ordinate pair. Any zone of the battlefield may be designated as being under attack by indirect fire weaponary, such as zones (B, 2), (E, 3) and (E, 5) which are under artillery fire, zones (0,1) and (F2) which are under mortar fire, and zones (B, 4) and (D, 6) which are mined. Tanks on the battlefield are arranged to receive battlefield information e.g. the areas, type and severity of attack, from transmitter T_0, and further transmissions from transmitters T_1, T_2 so that location may be computed. If a tank is in an area under indirect fire, a kill probability for that fire is computed and a signal given indicating whether simulated damage has been sustained.

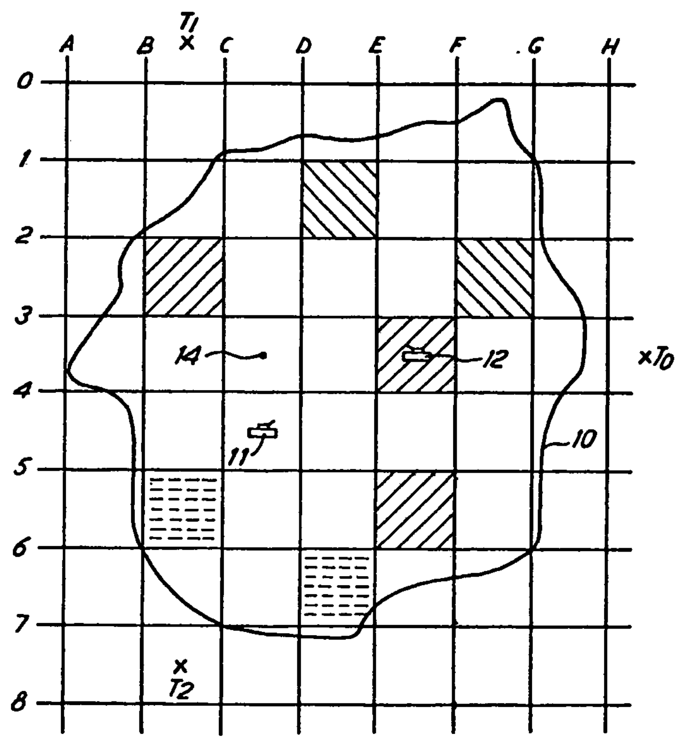

FIG. 1

GB 2 176 271 A

The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.

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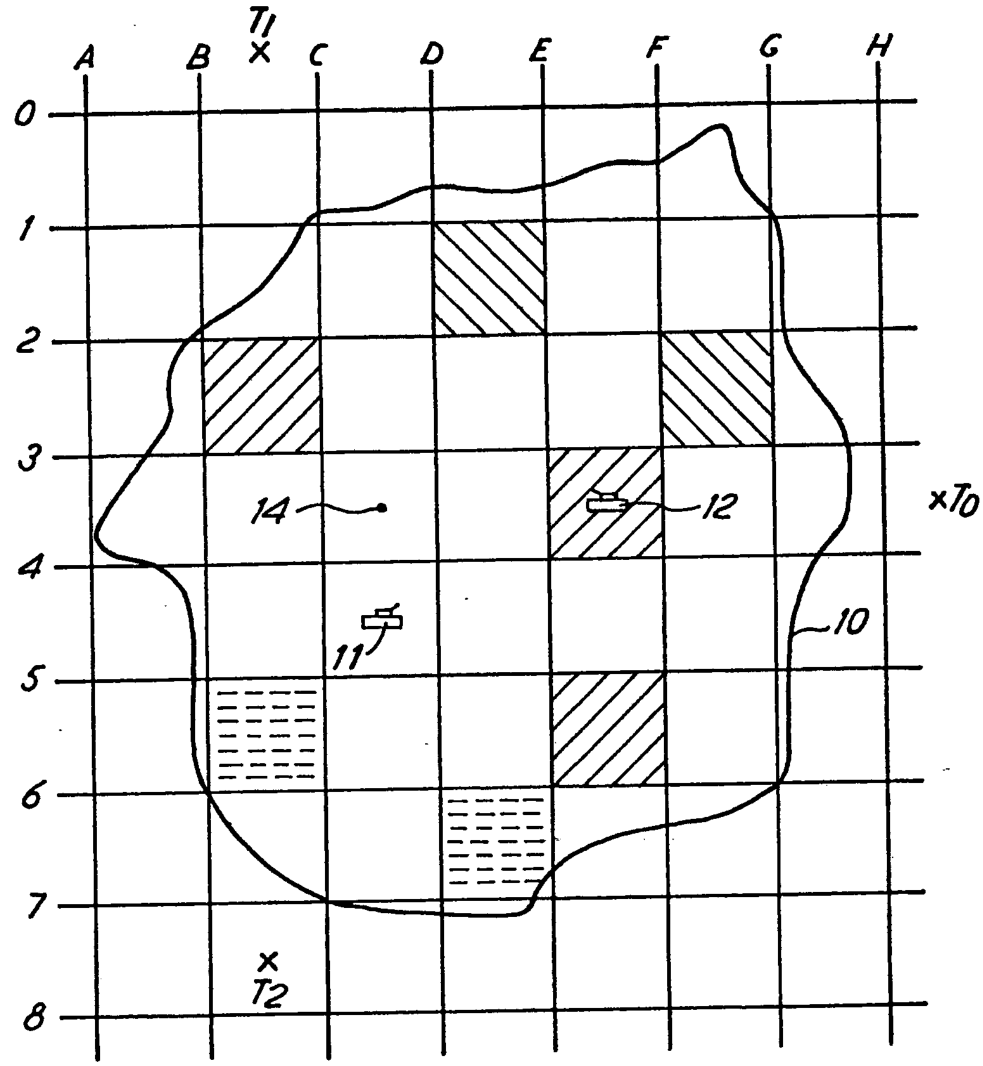

FIG.1

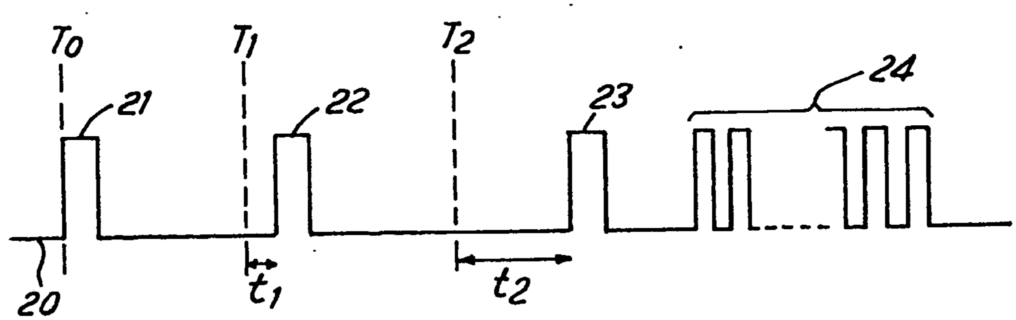

FIG.2

SPECIFICATION

Improvements in weapon training systems

This invention relates to weapon training systems and in particular to the simulation weapons effects.

Weapon training systems for training weapon operators in aiming and firing procedures without the expense and danger of firing live ammunition are well known and are described in British Patent Specifications Nos. 1 228 143, 1 228 144 and 1 451 192. In these systems, a weapon is typically sighted on a target, and a source of electromagnetic radiation, such as a laser, contained in the training systems and aligned with the weapon, is used to determine the range of the target. Thereafter, the weapon is aimed by offsetting it in elevation and azimuth, to take account of the range (and motion, if any) of the target. When the weapon is 'fired', the laser beam is offset in the opposite sense by the correct amounts for a target having the measured range and motion, so that, if the weapon has been correctly aimed, the offsets applied to the weapon are exactly compensated and the ultimate orientation of the laser beam (the beam datum direction) corresponds to the direction to the target. Energisation of the laser can then be detected at the target to indicate a hit, the information being conveyed back to the weapon site for example by radio. Alternatively a detector at the weapon site may receive radiation reflected by a reflector at the target, as for example described in British Patent Specification 1 439 612.

Such systems are in use for the training of personnel in the operation of direct fire weapons. There is an increasing need for such systems to have a capability which extends beyond training and to provide a full battlefield simulation. Target mounted equipment may be installed to compute kill probability when incidence of radiation is detected, and to indicate that a target has been destroyed so that it may take no further part in the simulation.

Whilst a realistic simulation of direct fire engagement, such as a tank or infantry battle may be provided, indirect fire weapons, such as over the horizon artillery or mortar, or minefields cannot be simulated.

It is an object of the present invention to provide a weapons effect simulator capable of simulating the effects of indirect fire weapons.

According to the present invention an indirect fire weapons effect simulator includes

transmitter means for transmitting information receivable over a battlefield,

target mounted receiver means for receiving location and battlefield information, and

target mounted computer means for computing target location in response to said location information, and target kill probability in response to said battlefield information.

Preferably, location information is transmitted by at least three time referenced pulses transmitted from different positions, advantageously by means of a reference pulse from a master transmitter and two delayed pulses from synchronised slave transmitters.

For preference the battlefield information comprises co-ordiante references of designated attack areas and type and severity of attack in each area. Advantageously battlefield information is transmitted by a master transmitter.

In one arrangement of the present invention battlefield attack designations are centrally controlled and may be directly updated.

Alternatively attack designations may be linked to actual weapons operations by way of fully simulting an engagement. Advantageously all simulation computations, including any contemporaneous direct fire engagements, are synchronized to a single reference.

Targets may additionally have transmission capablility so that information about each target may be centrally received, and a complete log of the simulation made available.

In order that features and advantages of the present invention may be appreciated an embodiment will now be described with reference to the accompanying diagrammatic drawing of which:

Figure 1 represents a battlefield simulation, and

Figure 2 represents typical target reception.

On a simulated battlefield 10 (Fig. 1) a simulated direct fire engagement between a first tank 11 and a second tank 12 is underway. The simulation proceeds by virtue of direct fire weapons simulation equipment, as for example that described in the preamble to this specification, installed on both tanks.

The engagement is to be subject to the additional simulation of indirect fire and for this purpose the battlefield 10 is notionally divided into an orthogonal grid having co-ordinates (A, B, C, D, E, F, G, H) and (0, 1, 2, 3, 4, 5, 6, 7, 8). A zone of the battlefield may thus be identified by a co-ordinate pair such as (C, 3) which identifies zone 14.

Any zone of the battlefield may be designated as being under attack by indirect fire weaponary, such as zones (B, 2), (E, 3) and (E, 5) which are under artillery fire, zones (0, 1) and (F, 2) which are under mortar fire, and zones (B, 4) and (D, 6) which are mined.

Tanks on the battlefield are arranged to receive battlefield information, for example, form radio transmitter T_0, and to compute whether they are in an area under indirect fire, and if so to compute a kill probability for that fire and to signal whether they have sustained damage. Algorithms for assessing kill probability and damage are well known and will not be discussed further here.

In order for target vulnerability to be assessed, the zone at present occupied by a

target must be known in addition to the battlefield information. Location may be computed by receiving transmisssions from two further transmitters T_1 and T_2. It will be appreciated that placement of transmitters T_0, T_1 and T_2 allows straightforward triangulation, but that in practice any number greater than two of transmitters placed at convenient locations may be used, provided the locations are accurately defined, and their positions known to the target borne computer before the simulation commences.

In one embodiment of the present invention transmitters T_0, T_1 and T_2 are pulse transmitters, T_0 arranged as a master and T_1 and T_2 as slaves. T_0 transmits a pulse, which may be regarded as a reference or synchronising pulse, which preferably acts to synchronise all simulation operations. Slave transmits T_1 and T_2 are arranged to transmit a further pulse after a fixed delay following reception of the reference pulse. The fixed delay in transmission of transmitter T_2 may for example be twice that of transmitter T_1. It will be appreciated that by measuring the time delays in actual reception of pulses from T_1 and T_2 after the known transmission times respectively, sufficient information is available for target location to be computed.

For a typical reception pattern 20 (Fig. 2), pulses 21, 22 and 23 are received. Pulse 21 is the reference pulse.

Pulse 22 is received from transmitter T_1 at a time t_1 after actual transmission and pulse 23 from transmitter T_2 at t_2 after actual transmission of that pulse. Pulse train 24 represents transmission from transmitter T_0 of battlefield information, which is coded information about areas under attack, and attack severity. Further transmissions follow each reference pulse.

Initially and before simulation a target, such as for example tank 12 (Fig. 1) is loaded with information giving transmitter location, transmission delays and intial battlefield designations. For a simple simulation, the battlefield designations may remain unchanged and no further battlefield information need be transmitted. Generally however, it is desirable to change battlefield configuration as the simulation proceeds.

During simulation reference pulses are received by tank 12. Following each reference pulse are location pulses, from which a tank mounted computer computes in which zone the tank is currently located. Battlefield information is then received and monitored for information about the currently occupied zone. In the present example, zone (E,5) occupied by tank 12 is designated as under artillery attack. Tank 12 computer loads information relating to zone (E, 3) and performs a kill probability computation based on the received nature and severity of attack. This cycle is repeated with each reference pulse as the simulation proceeds and is additional to any direct fire engagement (for example with tank 11) under simulation, computations for which may also be synchronised by transmitter T_0 reference pulses.

Battlefield designations may be externally controlled by updating a battlefield master store, which holds battle fild information to be transmitted. Thus a simulation umpire may control indirect fire simulation from a console.

Alternatively the scope of the simulation may be considerably extended by updating the store from actual weapons simulations, for example actual operation of over the horizon mortars, provided suitable simulation and transmission equipment is attached to the weapons for their simulated operation to be input to the store.

Preferably actual firing co-ordinates are used. Where artillery is to be simulated, the battlefield store may be advantageously interfaced to an artillery fire control system.

CLAIMS

1. An indirect fire weapons effect simulator including:—
transmitter means for transmitting information receivable over a battlefield,
target mounted receiver means for receiving location and battlefield information, and
target mounted computer means for computing target location in response to said location information, and target kill probability in response to said battlefield information.

2. An indirect fire weapons effect simulator as claimed in claim 1 and wherein location information is transmitted by at least two time referenced pulses transmitted from different positions.

3. An indirect fire weapons effect simulator as claimed in claim 1 or claim 2 and wherein the battlefield information comprises co-ordinate references of designated attack areas and/or attack type and/or attack severity.

4. An indirect fire weapons effect simulator as claimed in claim 1, claim 2 or claim 3 and wherein the attack designations are centrally controlled.

5. An indirect fire weapons effect simulator as claimed in any preceding claim and wherein the battlefield information includes data to influence kill probabilty computations of a direct fire simulation.

6. An indirect fire weapons effect simulator as claimed in any preceding claim and wherein the battlefield and location information is derived at least in part from an artillery fire control system.

7. An indirect fire weapons effect simulator substantially as herein described with reference to the drawings.

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